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10/759,511	01/15/2004	Hans W. Bruesselbach	B-4759NP 621649-7	7055

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LADAS & PARRY
5670 WILSHIRE BOULEVARD, SUITE 2100
LOS ANGELES, CA 90036-5679

EXAMINER	
PEACE, RHONDA S	

ART UNIT	PAPER NUMBER
2874	

MAIL DATE	DELIVERY MODE
08/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/759,511	BRUESSELBACH ET AL.	
	Examiner	**Art Unit**	
	Rhonda S. Peace	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 May 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,7-14,16,17,19-28,30 and 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, 7-14, 16, 17, 19-28, 30, and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 9, 20, 21-23, 25-27, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li (US 6385371), in further view of Wong (US 5408556).

Pertaining to claim 1, Li discloses a plurality of glass optical fibers **32** having first ends and second detached ends **34**, where the fibers **32** are tapered, as seen in Figure 3, to form a tapered region **28**, and a facet **24** formed upon said tapered region **28** in a direction perpendicular to the optical axis of said fibers **32**. See col. 3 lines 51-67, col. 4 lines 1-67, col. 5 lines 1-59, and Figure 3. Said facet **24** may be formed in various sizes and shapes, thereby inherently including a facet diameter size other than approximately equal to the cross section of an individual single-mode fiber. See col. 4 lines 8-19, Figure 3. However, Li does not disclose forming the facet being formed by cutting and polishing or by cleaving, and Li does not disclose fusing the plurality of fibers along a section of each fiber proximate the first end of said fibers to form a fused and tapered section.

Further pertaining to claim 1, Wong discloses a fiber optic apparatus for coupling light comprising a plurality of single mode optical fibers **12-19** being fused together to

form fused section **20** that is tapered along section **22**. See Figures 1 and 5, col. 3 lines 40-65. The ends of the optical fibers **12-19** opposite the fused section **20** are detached from one another, as seen in Figure 1. Moreover, a cleaved facet is formed along the fused section **20** such that the facet is perpendicular to the fiber axis of the fused section **20**, as seen in Figure 5.

In conclusion with respect to claim 1, one of ordinary skill in the art would have found it obvious to form Li's facet by a cleaving method, as Wong discloses cleaving is an easy way to construct such a facet that is capable of effective light transmission. See Wong, col. 2 lines 45-49. Moreover, one of ordinary skill in the art would have found it obvious to use a fusing method to form the tapered section of Li's apparatus, as Wong discloses the fusing method is an easy method by which to form a tapered bundle, and further states the fusing method allows for the even distribution of optical energy among all fibers within the bundle. See Wong col. 2 lines 45-49, and col. 5 lines 3-23. Even signal distribution among the plurality of optical fibers **32** is a stated goal of Li. See Li, col. 2 lines 6-11.

Concerning claim 9, the combination of Li and Wong disclose the optical coupling device as described above. As previously stated, even signal distribution among the plurality of optical fibers **32** is a stated goal of Li. See Li, col. 2 lines 6-11. However, Li does not disclose uniformly stretching the fused section to provide the desired amount of coupling between each optical fiber. Wong discloses the fibers disposed in the fused section **20** are uniformly stretched to provide a desired amount of optical coupling between the fibers. See col. 5 lines 3-23, Figure 8. It would have been obvious to one

of ordinary skill in the art to uniformly stretch the fused section of the fiber bundle to provide the desired amount of coupling between each optical fiber in the bundle, as taught by Wong, as Wong discloses such stretching allows optical energy to be distributed evenly across all fibers within the bundle, and therefore is a method which accomplishes the above stated goal of Li. See Wong, col. 5 lines 3-23.

With respect to claims 20 and 27, the combination of Li and Wong disclose the optical coupling device as described above. Moreover, Li shows the facet **24** may be illuminated with a single optical input traveling in free space, wherein said input is distributed amongst each fiber **32** to provide a plurality of distributed optical outputs, as seen in Figures 3 and 4-8. As seen in Figure 3, the diameter of input **24** is substantially larger than the diameter of the outputs **34**, and therefore it follows that when the coupler is fashioned to these shown dimensions, the diameter of an optical signal at the input **24** is larger than the diameter of the same optical signal at any of the outputs **34**. However, Li does not disclose said fibers as single-mode fibers. Wong does disclose the use of single-mode fibers within such a coupling device. See Wong, col. 50-55. One of ordinary skill in the art would have found it obvious to use single-mode fibers, as Li does not limit their coupler to any particular type of fiber, and Wong teaches the need for a low-loss splitter for single-mode fibers capable of multiplexing a single input into a large number of outputs. See Wong, col. 2 lines 45-50.

Concerning claims 21-23, 25, 26 and 31, the combination of Li and Wong disclose the optical coupling device as described above. Wong discloses the fibers are provided in a glass matrix **53** during the tapering process. See col. 3 lines 49-54, and

col. 5 lines 3-23. Figure 3 of Li shows said fibers **32** are formed within a square close packed array. Moreover, in the fusing and stretching method disclosed above by Wong, it is inherent that the core size of a given fiber within the taper portion is smaller than the core diameter of the same given fiber in the non-tapered (non-stretched) portion. In addition, Li discloses the fibers **32** may be of differing size, as each may have a cross-section that is greater than, equal to, or smaller than, their corresponding interface section **36**. See col. 4 lines 28-49. As Li discloses elements **32** as fibers, each fiber **32** inherently has its own core, cladding, and mode shape. However, Li does not disclose calculating the sum of the mode shapes and selecting the core/cladding size ratio and stretch such as to maximize coupling of the free space beam into the core ensemble.

Speaking specifically to claims 25 and 31, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure, rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ 2d 1429, 1431-32 (Fed. Cir. 1997). Therefore, with regard to the limitation of calculating the sum of the mode shapes and selecting the core/cladding size ratio and stretch such as to maximize coupling of the free space beam into the core ensemble, claim 25 only requires the device to be formed such that coupling of the free space beam is maximized. While Li does not explicitly teach such coupling is maximized, it would have been obvious to one of ordinary skill in the art to maximize free space coupling, as Li is concerned with minimizing optical loss as much as possible in order to conserve the optical signal. See Li, col. 5 lines 9-51.

Claim 24 is rejected under 35 USC 103(a) as being unpatentable over Li (US 6385371), in further view of Wong (US 5408556), in still further view of Berkey (US 4915467).

Concerning claim 24, Li in view Wong discloses the coupling device as described above. However, Wong does not disclose the glass matrix comprising fluorosilicate. Berkey discloses the use of a fluorosilicate matrix to enclose an optical fiber during a heating process (col. 10 lines 61-68, and col. 11 lines 1-2). It would have been obvious to one of ordinary skill in the art to combine the teachings of Wong and Berkey, as the use of fluorosilicate glass for the matrix creates an optical fiber coupler having a solid cross-section free of air lines or bubbles (col. 11 lines 1-2 of Berkey). Air bubbles or lines would disrupt optical coupling between the cores of the optical fibers in Wong, and therefore this method of Berkey is advantageous when used with the method of Wong, as it ensures high optical coupling between the cores of the fibers within the fused portion of the apparatus. Creating high optical coupling between the cores of the fibers within the fused portion of Wong's apparatus is of great concern to Wong. See Wong, col. 5 lines 5-29.

Claims 5 and 14 are rejected under 35 USC 103(a) as being unpatentable over Wong (US 5408556), in further view of Russell et al (US 4932747).

With regard to claims 5 and 14, Wong discloses a fiber optic apparatus for coupling light comprising a plurality of single mode optical fibers **12-19** being fused together to form fused section **20** that is tapered along section **22**. See Figures 1 and 5,

col. 3 lines 40-65. The ends of the optical fibers **12-19** opposite the fused section **20** are detached from one another, as seen in Figure 1. Moreover, a cleaved facet is formed along the fused section **20** such that the facet is perpendicular to the fiber axis of the fused section **20**, as seen in Figure 5. Moreover, Wong discloses the fibers disposed in the fused section **20** are uniformly stretched to provide a desired amount of optical coupling between the fibers. See col. 5 lines 3-23, Figure 8. In addition, as the fused portion **20** is stretched to form a taper portion **22** (col. 3 lines 61-63), it is inherent that the core size of a given fiber within the taper portion is smaller than the core diameter of the same given fiber in the non-tapered (non-stretched) portion. However, Wong does not disclose the apparatus is useable as a combiner, where an optical input may be provided to the plurality of unfused fibers and combined into a single output at the facet. Russell et al discloses a combiner having a very similar structure to that of Wong, where an optical input may be provided to the plurality of unfused fibers and combined into a single output at the facet. See Russell et al, col. 7 lines 12-27. It would have been obvious to use the splitter of Wong as a combiner, as is described by Russell et al, as doing so will increase the overall usability and functionality of the device, allowing the apparatus of Wong to bi-directionally function not only as a multiplexer, but also as a demultiplexer.

Claims 2-4, 8, 10-13, 17, 19, 28, and 30 are rejected under 35 USC 103(a) as being unpatentable over Wong (US 5408556).

With regard to claims 11, 28, and 30, Wong discloses a fiber optic apparatus for coupling light comprising a plurality of single mode optical fibers **12-19** being fused together to form fused section **20** that is tapered along section **22**. See Figures 1 and 5, col. 3 lines 40-65. Fibers 12-19 inherently include a core, cladding, and mode shape. The ends of the optical fibers **12-19** opposite the fused section **20** are detached from one another, as seen in Figure 1. Moreover, a cleaved facet is formed along the fused section **20** such that the facet is perpendicular to the fiber axis of the fused section **20**, as seen in Figure 5. Moreover, Wong discloses the fibers disposed in the fused section **20** are uniformly stretched to provide a desired amount of optical coupling between the fibers. See col. 5 lines 3-23, Figure 8. In addition, as the fused portion **20** is stretched to form a taper portion **22** (col. 3 lines 61-63), it is inherent that the core size of a given fiber within the taper portion is smaller than the core diameter of the same given fiber in the non-tapered (non-stretched) portion. However, Wong does not disclose the facet receiving an optical signal via free space, wherein said signal is distributed to said plurality of fibers to provide a plurality of outputs. Instead, Wong discloses said input being received from another optical fiber, wherein said input is then distributed to said fibers to provide a plurality of optical outputs. Nonetheless, being that the apparatus is capable of receiving an optical input, it would have been obvious to one of ordinary skill in the art to use any optical source in conjunction with the apparatus, including an optical signal propagating in free space.

With specific respect to claim 28, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished

from the prior art in terms of structure, rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78, 44 USPQ 2d 1429, 1431-32 (Fed. Cir. 1997). Therefore, with regard to the limitation of calculating the sum of the mode shapes and selecting the core/cladding size ratio and stretch such as to maximize coupling of the free space beam into the core ensemble, claim 28 only requires the device to be formed such that coupling of the free space beam is maximized. While Wong does not explicitly teach such coupling from an outside source (such as a fiber or free space) is maximized, it would have been obvious to one of ordinary skill in the art to maximize input coupling, regardless of the source, be it free space or another fiber, as Wong is concerned with minimizing optical loss as much as possible in order to conserve the optical signal. See Wong, col. 2 lines 45-50.

Addressing claims 2-4, 8, 10, 12, 13, 17, 19, Wong discloses the apparatus described above. Moreover, as can be seen in Figures 2 and 3, the fibers **12-19** are arranged in a close-packed hexagonal array, and further are provided in a glass matrix **53** during the tapering process. See col. 3 lines 49-54, and col. 5 lines 3-23. In addition, as the fused portion **20** is stretched to form a taper portion **22** (col. 3 lines 61-63), it is inherent that the core size of a given fiber within the taper portion is smaller than the core diameter of the same given fiber in the non-tapered (non-stretched) portion. Furthermore, Wong discloses that the optical fibers range in core sizes from 3-5 microns, thereby creating an apparatus where at least one fiber of the plurality of fibers has a different core size from at least one other optical fiber of the plurality of fibers. See col. 3 lines 49-58. Moreover, the diameter of the optical signal at the facet is larger than the diameter of the optical signal upon exiting the detached ends of optical

fibers **12-19**; this may be determined as the diameter of the core of the facet is approximately 10 microns, whereas the core diameter of the fibers at the detached end of each fiber is between 3 and 5 microns. See col. 3 lines 49-58, and col. 4 lines 6-11, Figures 3 and 4.

Claims 7 and 16 are rejected under 35 USC 103(a) as being unpatentable over Wong (US 5408556), in further view of Berkey (US 4915467).

Concerning claims 7 and 16, Wong discloses the apparatus and method as described above. However, Wong does not disclose the glass matrix comprising fluorosilicate. Berkey discloses the use of a fluorosilicate matrix to enclose an optical fiber during a heating process. See col. 10 lines 61-68, and col. 11 lines 1-2. It would have been obvious to one of ordinary skill in the art to combine the teachings of Wong and Berkey, as the use of fluorosilicate glass for the matrix creates an optical fiber coupler having a solid cross-section free of air lines or bubbles. See col. 11 lines 1-2 of Berkey. Air bubbles or lines would disrupt optical coupling between the cores of the optical fibers in Wong, and therefore this method of Berkey is advantageous when used with the method of Wong, as it ensures high optical coupling between the cores of the fibers within the fused portion of the apparatus. Creating high optical coupling between the cores of the fibers within the fused portion of Wong's apparatus is of great concern to Wong. See col. 5 lines 5-29 of Wong.

Response to Arguments

Applicant's arguments, see page 13, filed 5/7/2007, with respect to the objection to claims 1, 11, 20, and 27-29 have been fully considered and are persuasive, as the Applicant's remarks have made the record clear that said facet is formed by one of two methods, either A) the combination of cutting and polishing, or, B) cleaving. The objection of claims 1, 11, 20, and 27-29 has been withdrawn.

Applicant's arguments, see page 12, filed 5/7/2007, with respect to the objection to claim 13 has been fully considered and is persuasive. The objection of claim 13 has been withdrawn.

Applicant's arguments with respect to claims 1, 20, 24 and 27 (pages 13-15, 19, and 20) have been considered but are moot in view of the new ground(s) of rejection made above. Statements made by the Applicant regarding the obviousness of Wong's bundle diameter being a size other than that of a single mode fiber are considered moot in view of the new grounds of rejection above.

Applicant's arguments filed 5/7/2007, with respect to the rejection of claims 5 and 14 in view of Wong and Russell et al, have been fully considered but they are not persuasive.

With respect to claims 5 and 14, Applicant argues it would be non-obvious to allow the splitter of Wong to act as a combiner, as the facet of Wong is attached to another fiber via a focusing element, and therefore the facet is not capable of emitting a signal into free space. The Examiner respectfully disagrees.

Figure 9 of Wong shows the tapered fiber bundle where the facet is unattached to another fiber, and therefore capable of transmitting/receiving an optical signal from free space at the facet. One of ordinary skill in the art would recognize that the device of Figure 9 is usable within other optical systems, and will have uses beyond the disclosure of Wong, such as the uses disclosed by Russell. One of ordinary skill in the art would have viewed the disclosure of Wong as a whole and would have found it obvious to modify the device for another purpose, such as for use as a combining element. The focusing element is only an essential feature when the bundle is further coupled to another optical fiber, and this is illustrated as the focusing element is absent within Figure 9. Therefore, Applicant's arguments with respect to claims 5 and 14 are found unpersuasive.

Applicant's arguments with respect to the rejection of claims 2-4, 8, 10-13, 17, 19, 28, and 30 under *35 U.S.C. 102(b)* in view of Wong have been considered but are moot in view of the new ground(s) of rejection made above under 35 U.S.C. 103(a) in view of Wong. Applicant's amendment necessitated new grounds of rejection for the above claims.

Applicant's arguments filed 5/7/2007, with respect to the rejection of claims 7, 11 16, and 28 in view of Wong under *35 U.S.C. 103(a)*, have been fully considered but they are not persuasive.

Applicant argues it would be non-obvious to allow the facet of Wong to receive an optical signal from free space, as the facet of Wong is attached to another fiber via a

focusing element, and therefore the facet is not capable of receiving a signal from free space. The Examiner respectfully disagrees.

Figure 9 of Wong shows the tapered fiber bundle where the facet is unattached to another fiber, and therefore capable of transmitting/receiving an optical signal from free space at the facet. One of ordinary skill in the art would recognize that the device of Figure 9 is usable within other optical systems, and will have uses beyond the disclosure of Wong. One of ordinary skill in the art would have viewed the disclosure of Wong as a whole and would have found it obvious to modify the device for another purpose, such as for use with a free space-propagating signal. The focusing element is only an essential feature when the bundle is further coupled to another optical fiber, and this is illustrated, as the focusing element is absent within Figure 9. Therefore, Applicant's arguments with respect to claims 7, 11 16, and 28 are found unpersuasive. Similarly, the arguments provided for claims 12, 13, 17, and 19 are also found unpersuasive.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rhonda S. Peace whose telephone number is (571) 272-8580. The examiner can normally be reached on M-F (8-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272- 2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Rhonda S. Peace
Rhonda S. Peace
Examiner
Art Unit 2874

Michelle R. Connelly Cushwa
MICHELLE CONNELLY-CUSHWA
PRIMARY EXAMINER
8/2/07